

CURIOUS NATURAL HYBRID SUNDEWS

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One Failure, One Success, One Mystery

You may remember me from my earlier colchicine treatment article (Snyder, 2000). Since that article, I have learned about some curiosities along similar lines that I would like to share with you. I would like to focus on wild *Drosera* native to North America.

I wish to discuss how hybridization in populations of plants plays an important role in evolutionary change. By important, I do not necessarily mean beneficial for the survival of the plant populations. We will examine the role of hybridization in three different sundews. The first sundew, *D. × obovata*, is an abundant hybrid which has proven to be an evolutionary dead-end. The second sundew, *Drosera anglica*, began as a hybrid and developed into a successful species¹. The third sundew, *D. capillaris*, exhibits signs of amphiploidy.

North American Species and Hybrids

In North America there are seven species of *Drosera*. These are *D. anglica*, *D. brevifolia*, *D. capillaris*, *D. filiformis*, *D. intermedia*, *D. linearis*, and *D. rotundifolia*. All seven are capable of hybridizing with one-another, giving a total of 21 possible F1 hybrid combinations. But not all 21 will be created naturally since not all seven are within cross-pollination distance. The three most common interspecies hybrids have been formally described and named. The most common natural hybrid by far is *D. × obovata* = *anglica* × *rotundifolia*. Next is *D. × beleziana* = *intermedia* × *rotundifolia*, followed by *D. × hybrida* = *filiformis* × *intermedia*. The latter two may be found in the New Jersey Pine Barrens. From North Carolina is *D. capillaris* × *intermedia* (Sheridan, 1987). One hybrid reportedly seen in Florida is *D. brevifolia* × *capillaris*. I think this one would be especially difficult to identify. Other hybrids are expected to turn up where both parents are sympatric. Two manmade hybrids of sympatric parents, *D. brevifolia* × *rotundifolia* (created by me) and *D. brevifolia* × *intermedia* (created by Jim Bockowski), proved to be good growers, though have not been recorded from nature.

There may be reasons that some hybrids have not been found—reasons beyond their merely having eluded detection (Butler, 1985). I discuss some possible reasons in this paper.

¹Note that Art.H.4.1 of the International Code of Botanical Nomenclature requires that the first legitimate name that refers to a taxon of hybrid origin must equally be applied to all subsequent filial generations, back-crosses and combinations of these if all parent taxa are known or can be postulated. So if it is assumed that *Drosera anglica* is derived from a hybrid involving *D. rotundifolia* as a parent species, then the only legitimate name of the back cross *Drosera anglica* × *D. rotundifolia* would also be *Drosera anglica*, and *Drosera × obovata* would be a synonym of *Drosera anglica*.—ed. (Jan Schlauer)

The familiar *Drosera × obovata* (commonly called the paddle-leaved sundew), is a cross between *D. anglica* and *D. rotundifolia*, and was the first sundew recognized to be a natural hybrid. It is found wherever both parent species grow together, and since the very common parents have a vast distribution, surely this hybrid must be the most widespread of all. *Drosera anglica* has long leaves and *D. rotundifolia* has round leaves, so the hybrid has an intermediate shaped leaf which is a long oval or obovate shape, like a canoe paddle. *Drosera × obovata* has never been documented to be able to form viable seeds. But is this an unbroken rule for this hybrid? Could this hybrid at times really be fertile?

The reason for infertility is probably, putting it simply, that when two incompatible plants are mated their chromosomes do not match up. Consider the easily understood case of *D. × obovata*. The *D. anglica* parent is tetraploid (four sets of chromosomes), and *D. rotundifolia* is a diploid (two sets of chromosomes). The offspring will have one-half of the pair of chromosomes from each parent, making *D. × obovata* a triploid (three sets of chromosomes). *Drosera × obovata* cannot produce viable pollen (or ovules) because its third set of chromosomes cannot divide or pair correctly.

The first natural hybrid sundew I ever saw was the paddle-leaf, here in my home state of California. I found a fantastic floating bog habitat around the edge of a beautiful lake using a hiking trail book (It is great fun to follow a trail guide, it is like decoding a treasure map). The hike to this habitat just outside the southern boundary of Lassen Volcanic National Park was a most memorable and awesome adventure.

Drosera × obovata is very rare in California but can be found in the northern part of the state at high elevation in sphagnum bogs. The treasure my map led me to was growing on rafts of fallen logs in sphagnum moss along with both parent species, and a few *Utricularia* species as well.

Despite my thrill at finding this habitat, I had in mind a search for something even more special. Even more exciting would be to find the most rare of rare; a plant so unknown it has not been formally documented—a fertile paddle-leaf. So while I was treading amongst the great numbers of *D. × obovata* growing over a vast area, I examined the plants carefully to see if I could find any that might have seed. (I was there in August at the time when seed capsules on *D. anglica* were fat and full of seed.) It was easy to pick out the flower stalks of the hybrid among the *D. anglica* because the *D. × obovata* stalks did not have enlarged seed capsules. Searching through what must have been a million sundews I looked over hundreds of barren stalks. Dissecting several, I found a few underdeveloped seed that I am sure would not have been viable. Still, after studying the matter of fertility in other hybrids, I feel certain there ought to be some that are fertile.

Nature's Success—*Drosera anglica*

As if these glistening carnivorous plants were not already fascinating enough, it seems we have only begun to learn of hybridization amongst the species. This, in my mind, elevates the sundew to a whole new level of fascination. It is a surprise to people the first time they learn that at least one species in North America is actually of hybrid origin. This is *D. anglica*, which started off as a cross between *D. linearis* and *D. rotundifolia* (Wood, 1955). But how can this be fertile? As was told previously, a hybrid with mismatched chromosomes will be sterile. By an accident of cell division a plant's chromosomes can double. This happens when a cell nucleus splits into two without the cell itself dividing. The mismatched chromosomes can then match up with their doubles. Any hybrid that has undergone this process is



Figure 1: A fertile *D. x obovata* plant. Photograph by Ed Read.



Figure 2: A fertile *D. x obovata* plant. Photograph by Ed Read.

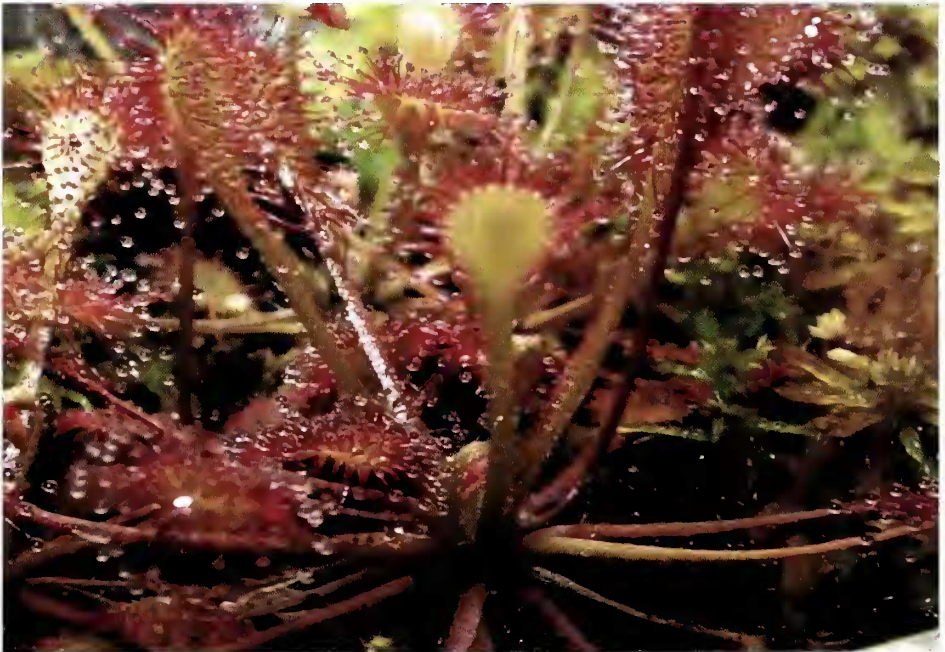


Figure 3: The *Drosera capillaris* plant with long leaves. Photograph by William DiLapi.

known as an allopolyploid or an amphiploid. This is a natural process that is not uncommon in plants.

Thanks to the efforts of Donald Schnell, the case of the origin of *D. anglica* is well studied and understood (Schnell, 1999). If what goes on with *D. × obovata* is any guide, it seems that countless *D. × anglica* must have germinated and died before one became fertile through amphiploidy. This process must have gone on eons for *D. anglica* to become so widespread. Creation of even more fertile *D. anglica* plants may continue where *D. linearis* and *D. rotundifolia* exist together. The origin of *D. anglica* is a good example of how all of nature's creations start off as accidents. While most of nature's experiments are doomed failures or dead ends, and relatively few prove successful.

Amphiploidy may also be induced artificially using chemicals, and can be an important tool in plant breeding. Recently the sundew has become a subject of such tinkering (Snyder, 2000). In theory, all sterile though otherwise healthy hybrids may be made fertile through chromosome doubling, although unpredictable side effects are possible—some plants will have improved vigor, while others are weakened. When the hybrid *D. × anglica* is chromosome doubled, the resulting fertile *D. anglica* is a more vigorous plant.

A Fertile *Drosera × obovata*?

So far, *D. × obovata* seems adversely affected by amphiploidy. When this triploid is doubled to a hexaploid it becomes very weak and unhealthy. This demonstrates that it is probably not capable of becoming a successful allopolyploid in nature. There is still the possibility of a far less common event, the natural creation of a tetraploid *D. × obovata*. While a normal triploid *D. × obovata* is the result of a cross between a diploid *D. rotundifolia* and a tetraploid *D. anglica*, if the parent *D. rotundifolia* used were a tetraploid the resultant *D. × obovata* would be tetraploid. Such a hybrid might be fertile. (Recall also that the *D. anglica* itself is already composed partly of *D. rotundifolia*, so its cross with *D. rotundifolia* will be partly compatible.

Using a tetraploid *D. rotundifolia*, I created a tetraploid *D. × obovata* that has proven to be fertile, albeit barely so (Figures 1, 2). (While the tetraploid *D. rotundifolia* has perfectly good pollen, its seed does not completely develop well. I think this flaw is the main reason the tetraploid *D. × obovata* has low fertility.) This gives some credence to the unpublished rumors of field discoveries of fertile *D. × obovata* plants. Schnell (1999) states that all North American *Drosera* hybrids are sterile, so the discovery of any fertile hybrid plants is important. Considering the vast range in which it could take place, I see no reason why this tetraploid form of *D. × obovata* would not also be naturally created, although I suspect this would be an extremely rare occurrence. Sadly, it seems that my prize the fertile paddle-leaf is an evolutionary dead-end. Because of low fertility, it is poorly suited to perpetuate and disperse by seed. This type of hybridization worked for *D. × anglica*, but failed in *D. × obovata*.

Mystery—A New Species From Florida?

Now let us examine another mysterious plant, something that appears to be a cryptic allopolyploid that, while perhaps fairly abundant in nature, has so far escaped scientific attention. While on a carnivorous plant hunting trip in Florida, fellow carnivorous plant nut Bob McMorris led me to a strange form of *D. capillaris* with very long petioles (Figure 3). (Some horticulturists have grown and traded this plant under the name *Drosera capillaris* "long arm", but this is not a cultivar name.) This plant has long slender upright petioles much like those in *D. intermedia*. Bob had told me of his belief that this plant was a hybrid between *D. capillaris* and *D.*

intermedia. When I first saw specimens, they did indeed appear to be just such a hybrid, but the plants at least appeared fertile because the capsules were full of seed.

At home, I wondered about these plants. Since the seeds germinated very well, it seemed unlikely the plants were a hybrid, and I felt that they were most likely an odd form of *D. capillaris*. After all, this can be a variable species. I have also noticed that the leaf shape is not the only aspect of *D. capillaris* that is variable—the style shape is also variable and the styles on some plants are bifid, much like those of *D. intermedia*. When I noticed this, I decided that this little plant deserves more study. I wondered if hybridization between *D. capillaris* and *D. intermedia* and subsequent allopolyploidy might indeed be occurring.

The idea regarding hybridization was not new with me. Phil Sheridan had reported finding *D. capillaris* × *intermedia* (see Front Cover) growing amongst the parent species in coastal North Carolina, USA (Sheridan, 1987). His article was planned as a preliminary study, but he became involved in other projects and never completed the work. The hybrids Phil found looked much the same as Bob's plants from Florida, but Phil's plants were sterile. Phil told me that he knew of the strange plants in Florida, and also suspected them to be allopolyploids (and possibly a new species).

How could we distinguish whether the plant is an allopolyploid? When a plant's chromosomes are doubled, cell size also doubles. While plant breeders usually compare pollen grain size with a plant of a known ploidy, with sundews I find it easier to simply compare the cells on the leaf surface. This I do with a 20× or 30× hand lens. When I looked at many clones of the strange long-petioled *D. capillaris* from Florida, I was surprised to see that indeed all had cells twice the size of ordinary *D. capillaris*. More testing is needed, but the possibility of a new allopolyploid looks promising.

Keep an Eye Out

We have only begun to unlock the secrets of *Drosera* and hybridization. Strange things lay hidden awaiting discovery. The study of carnivorous plants is unique and can be especially enjoyable. Even an amateur scientist such as myself can make satisfying and important discoveries! If you have the opportunity to visit a bog yourself, keep an eye out for that unusual sundew. Remember, a fertile paddle-leaf is possible, and this hybrid would be an extremely rare prize. There are surely many more sundew curiosities yet to be discovered around the world. Happy hunting!

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